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(54) Title of the invention: Information recording device and information reproducing device
(57) Abstract:
Problem to be solved: To solve problems of a conventional information recording and reproducing devices that cannot have sufficiently obtained a sense of reality, a stereoscopic sense and convenience of information at reproduction of the information because the conventional information recording and reproducing devices have had no information about accurate positions such as a depth of a sound source and an object and recorded audio information and image information or the like 1 dimensionally or 2 dimensionally. Solution: Information about positions of the sound source and the object is added to audio information and image information or the like and the resulting information is recorded. In the case of reproducing the sets of information above, the attached information about the positions is effectively utilized.

For example, in the case of the audio information, position information is added to each recording track by each musical instrument and a different propagation characteristic is provided to each track to generate a sound field with a depth at reproduction.

[Claims]

[Claim 1] An information recording device which records sound information expressed from the mentioned above sound source adding position information which specifies a spatial position of a sound source.

[Claim 2] An information reproducing device reproducing by performing the 1st processing that determines the propagation characteristic of the mentioned above sound information for sound information to which position information which specifies a spatial position of a sound source was added using the mentioned above position information on the mentioned above sound source.

[Claim 3] An information reproducing device which is the information reproducing device according to claim 2, and also uses a listener's position information when performing the mentioned above 1st processing.

[Claim 4] An information reproducing device which is the information reproducing device according to claim 3 which reproduces the mentioned above sound information also performing the 2nd processing that changes frequency of the mentioned above sound information in consideration of the Doppler effect, and position information on the mentioned above sound source or the mentioned above listener's position information changes, and is produced between a position of the mentioned above sound source, and the mentioned above listener's position.

[Claim 5] An information reproducing device which is the information reproducing device according to claim 3 or 4, and the mentioned above listener is plurality, and reproduces the mentioned above sound information to a plurality of the mentioned above listeners performing the mentioned above 1st processing or the mentioned above 1st and 2nd processings using the mentioned above position information corresponding to a plurality of the mentioned above listeners.
[Claim 6] An information recording device which records picture information of the mentioned above photographic subject and the mentioned above background adding distance to a photographic subject and a background as position information, an information recording device which detects whether position information on the mentioned above photographic subject and a background changes in time, and an equal distance side from the mentioned above information recording device of the mentioned above photographic subject shakes all over a screen.
[Claim 7] An information recording device in which position information on the mentioned above photographic subject changes in time, and recognizes movement of the mentioned above photographic subject by change of the mentioned above position information, and records sound information expressed from the mentioned above sound source adding position information which specifies a spatial position of a sound source and with which the mentioned above position information on the mentioned above sound source is updated with movement of the mentioned above photographic subject, the picture information of the mentioned above photographic subject and the mentioned above background is recorded adding distance to a photographic subject and a background as position information.

[Claim 8] An information recording device which records a plurality of sheets of the mentioned above picture information, changing a focusing point gradually, extracts a portion focused based on the mentioned above position information out of the mentioned above the mentioned above picture information of a plurality of sheets, and combines a picture of one sheet, the picture information of the mentioned above photographic subject and the mentioned above background is recorded adding distance to a photographic subject and a background as position information.
[Claim 9] An information recording device which records a plurality of picture information, changing a focusing point gradually, extracts a portion focused out of the mentioned above picture information of a plurality of sheets, and combines a picture of one sheet.
[Claim 10] An information recording device which records picture information of the mentioned above photographic subject and the mentioned above background adding distance to a photographic subject and a background as position information, including further a position measuring device for measuring a position of the mentioned above information recording device, and the mentioned above position measuring device specifying a position of the mentioned above information recording device measured by the mentioned above position measuring device as a temporary present location, and the mentioned above temporary present location is displayed on a map, determining 2 objects contained in the mentioned above map out of the mentioned above picture information, and each distance to the mentioned above 2 objects is prescribed by the mentioned above position information as the 1st and 2nd distance, an information recording device which draws 2 circles which

make the mentioned above 1st and 2nd distance into a radius, centering the mentioned above 2 objects on the mentioned above map, and judges an intersection of a direction near the mentioned above temporary present location among intersections of the mentioned above 2 circles to be a true present location.

[Claim 11] An information reproducing device while reproducing, determining a portion which should carry out image processing of the picture information to which distance to a photographic subject and a background was added as position information using the mentioned above position information on the mentioned above photographic subject and a background, and performing the mentioned above image processing into the portion concerned.

[Claim 12] An information reproducing device which reproduces sound information to which position information which specifies a spatial position of a sound source was added determining the propagation characteristic of the mentioned above sound information using the mentioned above position information on the mentioned above sound source and with which the mentioned above position information on the mentioned above sound source is updated with movement of the mentioned above photographic subject, the picture information to which distance to a photographic subject and a background was added as position information is reproduced, position information on the mentioned above photographic subject changes in time, and recognizes movement of a photographic subject by change of the mentioned above position information.

[Claim 13] An information reproducing device which is the information reproducing devices according to claim 11 which makes an image for left eye and an image for right

eye, and amended distance only with a horizontal part of azimuth difference from the mentioned above picture information using the mentioned above position information on the mentioned above photographic subject.
[Claim 14] An information recording device which records picture information of the mentioned above photographic subject and the mentioned above background, adding distance to a photographic subject and a background as position information, the mentioned above picture information also includes text information, and the mentioned above text information which is included in the mentioned above photographic subject or the mentioned above background is replaced.
[Claim 15] An information reproducing device which is the information reproducing device according to claim 11, the mentioned above picture information also includes text information, and the mentioned above text information which is included in the mentioned above photographic subject or the mentioned above background is replaced.

[Detailed description of the invention]

[0001]
[Field of the invention] This invention relates to the information recording device and the information reproducing device which record and reproduce what is called multimedia information, such as sound information and picture information.
[0002]
[Description of the prior art] The capability of the information recording device and the information reproducing device which record and reproduce multimedia information is developing quickly with improvement in the

information processing ability of a microprocessor. For example, the stereo components in which reverberation processing which adds delay processing to a reproduced sound using DSP (Digital Signal Processor) or produces reverberation in the field of sound information is performed, and can create various acoustic fields exist, in the field of picture information, the digital camera and personal computer which record a picture as digital information and can perform various image processing exist.

[0003]

[Problems to be solved by the invention] In the former information recording device and information reproducing device, a small number of loudspeaker and display were used as the reproduction means, information was recorded superficially, a sense of reality and a 3D effect are fully able to be acquired, and the convenience of information was not able to be acquired. Here, it is pointed out that the information according to exact positions, such as a sound source, depth of a photographic subject, and a sliding direction, as information is recorded superficially is not recorded at all or is recorded insufficiently.

[0004] For example, when recording stereo sound information, the acoustic image normal position of a longitudinal direction is performed by sound volume balance on either side, a time lag, and the like of a channel. That is, as shown on drawing 18, when the sound information reproduced from the right speaker SPR and left speaker SPL reaches the listeners located in listening point LP, stereo sound information is recorded as an acoustic image orientates to somewhere of the distance DC between loudspeakers.

Drawing 19 expressed this as an image of sound field data. In drawing 19, acoustic field SF2 which has spread before listening point LP consists of the acoustic field data image of the right channels Rch and the acoustic field data image of the left channel Lch which were shown on it. Round mark SD1L - SD3L and SD1R - SD3R in this acoustic field data image show the size of the volume of each sound source, and the distribution in an acoustic field. For example, since volume SD2R and SD2L of the right and left corresponding to a certain sound source are comparable, the normal position in an acoustic field becomes near a center. On the other hand, since volume SD3R and SD3L of the right and left corresponding to another sound source have right side larger than left side, the normal position in an acoustic field serves as a right side twist.

[0005] Thus, in the method of controlling the sound volume ratio of a loudspeaker on either side, although obtained about the normal position of a longitudinal direction, depth sensation, the upper and lower sides, and feelings in front and behind are not acquired.

[0006] Take out depth sensation with what pronunciation time is shifted for by a loudspeaker on either side (phase contrast is established) as what improves this or, the amendment art of the audio signal which took out the upper and lower sides and a sense of direction of order taking the sound source position specific operation by listeners' ear pinna into consideration and which is called 3D sound and the like exists. Drawing 20 expresses this art as an image of sound field data. Additional information AD1L - AD3L about amendment of phase contrast and the like and AD1R - AD3R are further added to round mark SD1L - SD3L and SD1R - SD3R which show the size of the volume of each

sound source, and the distribution in an acoustic field. Thus, acoustic field SF3 spreads to the front and rear, right and left upper and lower sides of the outside of a loudspeaker or a listening point, and it is large compared with acoustic field SF2.

[0007] But, in order that a sound recording engineer might add additional information in the stage which records the sound information from each sound source according to this art, the element with big a sound recording engineer's experience and subjectivity was occupied. Thus, the information about an exact position was not necessarily recorded.

[0008] After listeners stepped forward from the field of the triangle surrounded in the distance DL, DR between the loudspeaker of distance DC between loudspeakers, and right and left and a listening point as shown on drawing 18, there was also a problem that it became difficult for an acoustic field to become imbalanced and to obtain presence.

[0009] On the other hand, about picture information, there is often a case where a person and the like are stationed and recorded, for example into scenery. In this case, a picture is not only recorded superficially, and the information about the position or depth of a photographic subject is not necessarily recorded. Thus, for example, such picture information was acquired with the digital camera, and in the case where only a person is started from a background in a personal computer and the like, there is no other way, but for the difference of the color tone of a person and a background and the focus to have distinguished condition and also when the distinction was difficult.

[0010] This invention solves the mentioned above technical problem, and adds and records the information about the position of a sound source or a photographic subject on sound information, picture information, and the like, and the information recording device and information reproducing device which use the information about a position effectively at the time of reproduction of these information are realized.
[0011]
[Means for solving the problem] The invention according to claim 1 is an information recording device which records sound information expressed from the mentioned above sound source, adding position information which specifies a spatial position of a sound source.
[0012] The invention according to claim 2 is an information reproducing device while reproducing, performing the 1st processing that determines the propagation characteristic of the mentioned above sound information for sound information to which position information which specifies a spatial position of a sound source was added using the mentioned above position information on the mentioned above sound source.
[0013] The invention according to claim 3 is the information reproducing device according to claim 2, and when it performs the mentioned above 1st processing, it also uses a listener's position information.
[0014] The invention according to claim 4 is the information reproducing device according to claim 3, position information on the mentioned above sound source or the mentioned above listener's position information changes, and the mentioned above sound information is reproduced, also performing the 2nd processing that changes frequency of the mentioned above sound information in consideration of the

Doppler effect produced between a position of the mentioned above sound source, and the mentioned above listener's position.

[0015] The invention according to claim 5 is the information reproducing device according to claim 3 or 4, the mentioned above listener is plurality, and reproducing the mentioned above sound information to a plurality of the mentioned above listeners, performing the mentioned above 1st processing or the mentioned above 1st and 2nd processings using the mentioned above position information corresponding to a plurality of the mentioned above listeners.

[0016] The invention according to claim 6 is an information recording device which records picture information of the mentioned above photographic subject and the mentioned above background adding distance to a photographic subject and a background as position information, position information on the mentioned above photographic subject and a background changes in time, and it is detected whether an equal distance side from the mentioned above information recording device of the mentioned above photographic subject shakes all over a screen.

[0017] The invention according to claim 7 records picture information of the mentioned above photographic subject and the mentioned above background, adding distance to a photographic subject and a background as position information, position information on the mentioned above photographic subject changes in time, and recognizes movement of the mentioned above photographic subject by change of the mentioned above position information, sound information expressed from the mentioned above sound source is recorded adding position information which specifies a spatial position of a sound source, and the

mentioned above position information on the mentioned above sound source is updated with movement of the mentioned above photographic subject.

[0018] The invention according to claim 8 records picture information of the mentioned above photographic subject and the mentioned above background, adding distance to a photographic subject and a background as position information, a plurality of sheets of the mentioned above picture information are recorded changing a focusing point gradually, a portion focused based on the mentioned above position information out of the mentioned above the mentioned above picture information of a plurality of sheets is extracted, and a picture of one sheet is combined.

[0019] The invention according to claim 9 is an information recording device which records a plurality of picture information, changing a focusing point gradually, extracts a portion focused out of the mentioned above the mentioned above picture information of a plurality of sheets, and combines a picture of one sheet.

[0020] The invention according to claim 10 is an information recording device which records picture information of the mentioned above photographic subject and the mentioned above background adding distance to a photographic subject and a background as position information, including further a position measuring device for measuring a position of the mentioned above information recording device, and the mentioned above position measuring device specifying a position of the mentioned above information recording device measured by the mentioned above position measuring device as a temporary present location, and the mentioned above temporary present location is displayed on a map, determining 2 objects contained in the mentioned above map

out of the mentioned above picture information, and each distance to the mentioned above 2 objects is prescribed by the mentioned above position information as the 1st and 2nd distance, on the mentioned above map, 2 circles which make the mentioned above 1st and 2nd distance a into radius, centering the mentioned above 2 objects are drawn, and an intersection of a direction near the mentioned above temporary present location is judged among intersections of the mentioned above 2 circles to be a true present location.

[0021] The invention according to claim 11 is an information reproducing device reproduced determining a portion which should carry out image processing of the picture information to which distance to a photographic subject and a background was added as position information using the mentioned above position information on the mentioned above photographic subject and a background, and performing the mentioned above image processing into the portion concerned.

[0022] The invention according to claim 12 reproduces picture information to which distance to a photographic subject and a background was added as position information, position information on the mentioned above photographic subject changes in time, and recognizes movement of a photographic subject by change of the mentioned above position information, reproducing sound information to which position information which specifies a spatial position of a sound source was added determining the propagation characteristic of the mentioned above sound information using the mentioned above position information on the mentioned above sound source, the mentioned above position information on the mentioned above sound source is an

information reproducing device updated with movement of the mentioned above photographic subject.
[0023] The invention according to claim 13 is the information reproducing device according to claim 11, and makes an image for left eye and an image for right eye which amended distance only with a horizontal part of azimuth difference from the mentioned above picture information using the mentioned above position information on the mentioned above photographic subject.
[0024] The invention according to claim 14 records picture information of the mentioned above photographic subject and the mentioned above background, adding distance to a photographic subject and a background as position information, the mentioned above picture information also includes text information, and a character in which the mentioned above text information is included in the mentioned above photographic subject or the mentioned above background is replaced.
[0025] The invention according to claim 15 is the information reproducing device according to claim 11, the mentioned above picture information also includes text information and a character in which the mentioned above text information is included in the mentioned above photographic subject or the mentioned above background is replaced.
[0026]
[Embodiment of the invention] <Embodiment 1> This embodiment of the invention 1 shows the information recording device that while recording, adding the position information which specifies the spatial position of a sound source to sound information, and the information reproducing device which plays the sound information to

which position information was added using position information.

[0027] Drawing 1 is a drawing showing the scene where the information recording device according to this embodiment is used. The situation of recording a performance of the band on a stage is shown by drawing 1. Generally when recording, multi track recording is performed, a track is assigned for every musical instrument, and a performance is recorded. Here, as an example, the microphones Mc1-Mc3for the tenor sax Ts, the alto sax As, and the soprano sax Ss, the microphone Mc4 for the piano pf, the microphone Mc5 for the drums Ds, the microphones Mc6-Mc8 for the trumpets Tp1-Tp3, the microphone Mc9 for the trombone Tb, and the microphone Mc10 is assigned to the base B, respectively.

[0028] As shown on drawing 1 as an example, the position on this stage shall make the foremost left end the starting point, and shall be expressed with the coordinate component which set the Y axis as the depth direction and set the X axis as the longitudinal direction.

[0029]

[Table 1]

Microphone	Location (X[m], Y[m])	Audio track data number	Microphone	Location (X[m], Y[m])	Audio track data number
Mc1	(2.0, 2.0)	SD1	Mc6	(3.0, 4.0)	SD6
Mc2	(4.0, 2.0)	SD2	Mc7	(5.0, 4.0)	SD7
Mc3	(6.0,	SD3	Mc8	(7.0,	SD8

	2.0)			4.0)	
Mc4	(9.0, 1.5)	SD4	Mc9	(9.0, 4.0)	SD9
Mc5	(12.0, 3.5)	SD5	Mc10	(11.0, 5.0)	SD10

[0030] Table 1 shows each microphones Mc1-Mc10 and the audio track data numbers SD1-SD10 of those position and recorded data numbers. In the information recording device according to this embodiment, unlike the conventional case, the sound information which did not carry out a mix down at 2 stereos, but recorded multi track data is held, while it has been multi track.

[0031] In this embodiment, not only sound information but the position information which specifies the spatial position of a sound source is recorded at the time of the sound recording of each track. The position information on a sound source establishes the track only for position information in each track, and it may be made to write it in there, and may be made to write it in the empty portion of the track which writes in sound information. And what is necessary is just to carry out writing in only once as a fixed value or writing in periodically as a changing value or writing in, only when position information has change and the like.

[0032] The position information on a sound source may be determined based on the position of a microphone, and may be determined based on the position of a player or a musical instrument.

[0033] In drawing 1 or Table 1, in order to display simply, the case of the 2 dimensional position information on the X axis and the Y axis is shown, but it is good also as 3 dimensional position information to add the coordinate component of Z axis orientations vertical to both axes.
[0034] Thus, use of the sound information on which position information was recorded is explained next. The sound can take out depth sensation with performing delay processing and reverberation processing like stereo components with the mentioned above DSP built-in. The upper and lower sides and a sense of direction of order can be taken out with amending an audio signal, taking a sound source position specific operation, phase contrast, and the like by an ear pinna into consideration. Such delay processing and reverberation processing, and the compensation process should just apply the art in which it is used with conventional stereo components and 3D sound art, as it is. Depending for delay processing, reverberation processing, and a compensation process on a sound source and listeners' physical relationship greatly, and the parameter about these processings, if some of reverberation levels, time delays, a propagation medium, the construction material of a wall, and the like are decided preliminary, it will be automatically decided by a sound source and listeners' physical relationship being determined. The parameter about these processings is expressed as «the propagation characteristic of sound information» by this application. The compensation process by a sound source position specific operation according to delay processing, reverberation processing, and an ear pinna in the propagation characteristic of sound information, phase contrast, and the like, expressing the influence of the construction material of the influence of a

wind, a wall, and the like by changing a loudness level of sound in time or devising delay processing and change of a loudness level of sound, and expressing the kinds (water, air, and the like) and density of the atmospheric temperature which is a change element of acoustic velocity or a propagation medium is included too.

[0035] Now, since the position information on a sound source is added to the sound information recorded by the information recording device according to this embodiment, respectively, the propagation characteristic of sound information can be determined for every sound source. Namely, for example by the conventional stereo components, when a propagation characteristic was determined about stereo sound information, processing will be made uniformly for the sound information by which the mix down was carried out instead of every sound source, and were hard to acquire a 3D effect. If the propagation characteristic of sound information can be determined for every sound source, the sound information whose sense of reality increased more is renewable. According to 3D sound art, since the element with big a sound recording engineer's experience and subjectivity was occupied, the information about an exact position was not necessarily recorded. If the position information for every sound source is added, it will become possible to determine the propagation characteristic of sound information with more sufficient accuracy, using exact position information.

[0036] Drawing 2 is a drawing showing the scene where the information reproducing device according to this embodiment which determines the propagation characteristic of sound information for every sound source is used.

The acoustic field data image of acoustic field SF1 formed when each audio track data SD1 - SD10 shown on Table 1 is reproduced from the loudspeakers SPL, SPR is shown by drawing 2. The acoustic field data image of each audio track data SD1 - SD10 corresponds with arrangement of each musical instrument on the actual stage shown on drawing 1.
[0037] This acoustic field data image shows the case where the propagation characteristic of sound information is determined so that it may become the optimal, when listeners are in listening point LP1. What is necessary is just to newly determine the propagation characteristic of sound information, after detecting listening point LP2 temporarily since the propagation characteristic of sound information becomes less the optimal as it was when listeners move to listening point LP2 from listening point LP1. It may be made to wait for the input of the position information from listeners, a CCD ranging sensor and an infrared sensor are provided in the information reproducing device according to this embodiment, and it may be made to carry out automatic detection to pinpointing of listeners' place.
[0038] What is necessary is making it just change the sound information made to output according to arrangement of each loudspeaker, when a plurality of loudspeakers beyond it exist, of course, although drawing 2 shows the case acoustic field formation being carried out by 2 loudspeakers as an example. When the throughput of the sound information of the information reproducing device according to this embodiment is low and it is difficult to reproduce independently about multi track all, for example, the position of a sound source compounds the sound information of near to one, and it may be made to reduce a track number.

[0039] What is necessary is just to reproduce sound information, changing the frequency of sound information in consideration of the Doppler effect produced between the position of a sound source, and listeners' position (for example, when using a wireless microphone and the like), when a sound source moves. The Doppler effect points out the thing of a phenomenon which changes compared with the time of being the frequency of the sound expressed from the sound source which moves at the stillness time. This phenomenon,

[0040]

[Formula 1]

$$f = c - V_o \cos\varphi / c - V_S \cos\theta \cdot f0$$

[0041] it is quantitatively expressed. In formula 1, c expresses an audio speed for the frequency of the sound by which f0 is emitted from the sound source at the time of stillness in the frequency of the sound information from which listeners receive f, respectively. It is as other parameters shown on drawing 3. Namely, v_0 is the absolute value of movement speed in listeners' present location point 0, v_S shows the angle of the angle of the movement speed of the listeners from a straight line to whom φ and θ connect listeners' their present location point 0 and the their present location point S of a sound source for the absolute value of the movement speed in the their present location point S of a sound source, and the movement speed of a sound source, respectively.

[0042] Thus, what is necessary is just to perform a compensation process which carries out the multiplication of the coefficient of f0 in Formula 1 determined by c, v_0, v_S, φ, θ to frequency of sound information about sound information expressed from a sound source which moves. By deciding

parameters, such as atmospheric temperature and a propagation medium, the audio speed c is determined and v_0, v_S, φ, θ, it can be obtained by calculating a temporal change of position information on a sound source, and a temporal change of listeners' position information, it is not difficult to calculate a coefficient of f0 in Formula 1.

[0043] A block diagram of an information reproducing device provided with a function reproducing the mentioned above Doppler effect is shown on drawing 4. In drawing 4, relative relation calculation processing block ST1 computes position information, such as distance between both, by acquiring sound source position information IFS and the listeners position information IFL, and it computes v_0, v_S, φ, and θ from a temporal change of position information of a sound source and listeners. And information is sent to pitch change processing block ST2 and propagation characteristic change processing block ST3. In pitch change processing block ST2, sound information and environment information (information about a kind, an account sound, and the like of a propagation medium) in virtual space are given, and the Doppler effect is added to sound information, in propagation characteristic change processing block ST3, environment information in an output and virtual space from pitch change processing block ST2 is given, and a propagation characteristic is added to sound information. And an output of propagation characteristic change processing block ST3 is given to sound reproduction processing block ST4, and is expressed to listeners.

[0044] When a plurality of listeners exist and it exists in a position from which each listeners differ, what is necessary is just to form relative relation calculation processing block ST1a - ST1c, sound reproduction process processing block

ST23a - ST23c, and music reproduction processing block ST4a - ST4c classified by listeners for every listeners, as shown on a block diagram shown on an information reproducing device at drawing 5. In connection with relative relation calculation processing block ST1a - ST1c being formed for every listeners, listeners position information IFLa - IFLc is also extracted for every listener, and it is inputted into a corresponding relative relation calculation processing block, respectively. Sound reproduction process processing block ST23a - ST23c shows pitch change processing block ST2 and propagation characteristic change processing block ST3 in drawing 4 collectively. A reproduction block is established according to listeners, in order to prevent interference with other listeners. There are headphone, a super directivity loudspeaker, and the like as an example of music reproduction processing block ST4a - ST4c classified by listeners.

[0045] In this case, since it lets different reconstructive processing for every listeners pass to the same sound information, it becomes possible to form an acoustic field suitable for each listener. An acoustic field according to a seat location of a driver or a navigator is individually set up with an audio playback unit in the car, forming a situation about which a pronunciation sound source and listeners move in virtual reality space, for example, if it does in this way or performing sound field correction which took a seat configuration of a concert hall into consideration with a domestic audio playback unit, and amending difference in acoustic field by position of seat in a concert hall become possible.

[0046] Since sound information expressed from a sound source will be recorded adding position information on a sound source if an information recording device according to this embodiment is used, position information on a sound source can be used at the time of playback of sound information, and it can be processed to sound information.
[0047] Sound information will be reproduced determining the propagation characteristic of sound information using position information on a sound source if an information reproducing device according to this embodiment is used, sound information which has a sense of reality and a 3D effect to listeners can be given. If listeners' position information is also used when determining a propagation characteristic furthermore, sound information according to listeners' position which has a sense of reality and more 3D effect can be given to a listener. If frequency of sound information is changed in consideration of the Doppler effect produced between a position of a sound source, and listeners' position, sound information which has a sense of reality and more 3D effect can be given to listeners. Determining the propagation characteristic of sound information using position information corresponding to a plurality of listeners, when listeners are plurality. Or sound information which has a sense of reality and a 3D effect by a plurality of listeners can be given by reproducing sound information to a plurality of listeners, changing frequency of sound information in addition to it.
[0048] <Embodiment 2> This embodiment of the invention 2 shows an information recording device while recording, adding distance to a photographic subject and a background as position information to picture information, and an information reproducing device which reproduces picture

information to which position information was added using position information.

[0049] Drawing 6 is a drawing showing composition of an information recording device according to this embodiment. In drawing 6, picture information which imaging device CM, such as a digital camera, captures, and imaging device CM, both position information on photographic subject SB0 and background BG that sensor element SS which measures distance of an infrared sensor, a CCD ranging sensor, an ultrasonic sensor, gravity, pressure sensor, and the like captured was recorded, and the picture information GA to which position information was added has been obtained. Position information on photographic subject SB0 and background BG refers to distance between imaging device CM and photographic subject SB0, and distance between imaging device CM and background BG.

[0050] Photographic subject SB0 and background BG are not only reflected, but information on distance between imaging device CM and photographic subject SB0 or background BG is recorded on the picture information GA for every unit block (every unit pixels, for example, a thing which turned number division into equal parts of the screen length or side, ultimately). This photographic subject SB0 consists of three object SB0a, SB0b, SB0c. Distance to the front part of object SB0b of a center where distance to the front part of object SB0a of the left to which distance to the front part of object SB0c of the right which exists most in this side as an example in drawing 6 exists to the front in 2.5 m and the second exists in 2.7 m and the very back is indicated to be 3.0 m. Distance to background BG is indicated to be 10.0 m.

[0051] The picture information GA recorded in this way with an information reproducing device according to this embodiment, position information on photographic subject SB0 and background BG or it is a device displayed individually. Thus, if position information on a photographic subject is added to picture information, when reproducing picture information, a background and a photographic subject can be distinguished easily, for example, image processing, such as starting only a person, will become easy from a background.

[0052] When imaging device CM is a video camera in which animation photography is possible, it is possible to use for blurring amendment position information added to picture information, as shown on drawing 7. That is, if an equal distance side from an imaging device of a photographic subject shakes gradually on the whole all over a screen, it is detectable being blurring. And if it amends to a moved part by blurring, an animation is recordable as if blurring did not exist.

[0053] An information recording device according to this embodiment may be used combining an information recording device about sound information in Embodiment 1. That is, as shown on drawing 8 at the time of record of picture information, when object OB (corresponding to a sound source in Embodiment 1) classified by equal distance side in Screen GA has been recognized by techniques, such as image recognition, it updates with the movement also about position information on a sound source to record. Next, even if data of a temporal response of position information on a sound source is not recordable among information recording devices about sound information in Embodiment 1,

a sound source can be moved in accordance with motion of object OB.

[0054] An information reproducing device according to this embodiment may be used combining an information reproducing device about sound information in Embodiment 1 like the above. That is, as shown on drawing 8 at the time of reproduction of picture information, when object OB (corresponding to a sound source) classified by equal distance side in Screen GA has been recognized by techniques, such as image recognition, it updates with the movement also about position information on a sound source to reproduce. Next, even if it does not have data of a temporal response of position information on a sound source among information reproducing devices about sound information in Embodiment 1, a sound source can be moved in accordance with motion of object OB.

[0055] The picture information of a photographic subject and a background will be recorded adding position information on a photographic subject and a background if an information recording device according to this embodiment is used, position information on a photographic subject and a background can be used at the time of reproduction of picture information, and it can be processed to picture information. Blurring is detectable by detecting whether on the whole, an equal distance side moves gradually all over a screen. By position information on a sound source being updated with movement of a photographic subject, even if it is an information recording device which cannot record data of a temporal response of position information on a sound source, a sound source can be moved in accordance with movement of a photographic subject.

[0056] The picture information will be reproduced determining a portion which should be carried out image processing using position information on a photographic subject, and performing image processing into the portion concerned if an information reproducing device according to this embodiment is used, a compression ratio of a photographic subject which exists in the distance can be raised or a photographic subject can be separated from a background. By position information on a sound source being updated with movement of a photographic subject, even if it is an information reproducing device which does not have data of a temporal response of position information on a sound source, a sound source can be moved in accordance with movement of a photographic subject.
[0057] <Embodiment 3> This embodiment of the invention 3 uses an information recording device according to Embodiment 2, in order to acquire a picture with large depth of field.
[0058] Drawing 9 explains depth of field. As for a picture captured by imaging device CM, such as the usual analog camera, a digital camera, a video camera, a focusing point (a focused position and distance from a focusing point to an imaging device are called focus distance) and depth of field (a range focused before and after a focusing point) usually exist.
[0059] A range which suits a focus of a depth direction becomes large, so that depth of field is large, and a picture carried out distinctly can be acquired.
[0060] Three conditions that object distance 1 to photographic subject with a diaphragm value of taking lens small (a diaphragm is open), 2 a case where depth of field is shallow (short), 3 a long focal distance of taking lens is near

are mentioned. For example, 1 using a taking lens of a focal distance (in a 35 mm film, it is about 100-200 mm), 2 flower and the like are captured by point blank range (tens of cm), and, 3 in the case of not more than f= 2.8 diaphragm value (focal distance / effective pupil diameter) near opening, the whole depth of field has only the range of several cm.

[0061] In depth of field of several cm, when taking a photograph of a flower, if a focus is doubled with a flower core, for example, as for the surrounding petal, it will be out of a focus. If it is going to double a focus also with the whole flower or a stem and a leaf, 3 cannot but enlarge a diaphragm value (it extracts) and the amount of exposure light falls inevitably, it becomes what shutter speed is reduced for (a shutter is opened for a long time (it is about several seconds from fraction seconds when it extracts to about f= 32 in the general amount of photographing light)), influence of blur by blurring, a wind, and the like comes out, and it does not become useful as a photograph.

[0062] In order that depth of field may solve a problem which becomes shallow by short distance photography, in a certain kind of camera, it extracts to f= 45 and there is also a thing with a mechanism which covers a underexposure by a stroboscope. However, images of a result of a photograph will differ considerably by differences (distribution of a color, an entering light angle, and light, diffusion, and the like) between available light and artificial light. The new problems that a strobe light is reflected and reflected to a photographic subject, a strobe light does not reach beyond a certain amount of distance (strobe light range = guide number / diaphragm value x film speed amendment) arise.

[0063] In a digital camera and a video camera which used not only a camera of an analog, but an optical system, a problem of such depth of field is generated similarly. However, in actual photography, since it may become photograph expression and an artistic expression by obscuring a background intentionally, the things with shallow depth of field itself are not necessarily problems as the whole optical equipment system. A point that it was the most difficult work setting up depth of field which a photography person means suit light volume of 3 conditions of the mentioned above 1 - 3, and controlling it rather unless there are knowledge and experience was a problem.
[0064] Next, a picture with large depth of field is acquired by using an information recording device according to Embodiment 2.
[0065] First, as photographic subject SB0a - SB0c is shown on drawing 10 seen from the upper surface, to photographic subject SB0a - SB0c, a photograph is taken using an information recording device which changes a focusing point gradually from FP1 to FP7, and includes imaging device CM, and picture information with position information is obtained. Depth of field corresponding to each focusing points FP1 - FP7 is expressed with D1 - D7. As for distance during each focusing point, it is desirable to determine in quest of depth of field at estimate, so that depth of field may not sever, but it may be made to set up a fixed value, such as 3 cm and 5 cm, suitably.
[0066] Now, since a photograph was taken by changing a focusing point gradually from FP1 to FP7 in the case of the mentioned above example, seven picture information from which condition of a focus differs will exist.

Among these, if a focused portion is extracted and compounded from each picture information of seven sheets, a picture with deep depth of field can be acquired.

[0067] In order to extract a focused portion from each picture information, a value of distance by a focusing point should just extract a value of distance of an imaging surface of the photographic subject, and a part of near picture information using position information about distance between imaging device CM and photographic subject SB0a - SB0c which are contained in each picture information.

[0068] Drawing 11 shows that a focused portion was extracted and compounded from each picture information. In drawing 11, the range WA is chosen as a portion of photographic subject SB0c which is the point among pictures captured under focusing point FP2 and the depth of field D2. The numerals A1 show a part of drawing 10, and the numerals A2 are showing only the range WA among pictures captured under the depth of field D2. As a portion where similarly the range WB is chosen as a portion of photographic subject SB0b which is the point among pictures captured under focusing point FP3 and the depth of field D3 and which is to the point of photographic subject SB0a, the range WC is chosen among pictures captured under focusing point FP5 and the depth of field D5. Also, the portion chosen as the range WB, should just choose from a portion except the range WA, a portion chosen as the range WC, the range WA should just choose from a portion except the range WB. Thus, if a focused portion is extracted one by one and compounded, a picture with large depth of field as a result can be acquired.

[0069] If it does in this way, as shown on drawing 12, a picture with which a focus was doubled can also be acquired on the whole wall surface which is not parallel to an imaging surface of photographic subject SB1. In a camera of an analog, although a slant face of goods or a building was captured using a mechanism in which an optic axis of a shift lens and the like is made to incline, without using such a mechanism, a picture which doubled a focus with the whole wall surface which is not parallel to an imaging surface can be acquired, and it becomes very effective.

[0070] Since a focused portion will be extracted and compounded if an information recording device according to this embodiment is used, a picture with large depth of field can be acquired.

[0071] Even if it is a case where information recording devices other than an information recording device according to Embodiment 2 are used, that is, even if it is a case where position information about distance between imaging device CM and photographic subject SB0 is not included in each picture information, it is possible to realize an information recording device which has the same effect as the above. That is, a focusing point is changed gradually, picture information of a plurality of sheets is obtained, and if a focused portion is extracted and compounded from each picture information, a picture with deep depth of field can be acquired. In this case, what is necessary is just to specify a focused portion by performing image processing which extracts a high frequency component to each of picture information of a plurality of sheets, in order to extract a focused portion from each picture information.

[0072] <Embodiment 4> This embodiment of the invention 4 uses an information reproducing device according to Embodiment 2, in order to obtain stereoscopic vision.
[0073] Drawing 13 is a drawing showing a principle of a stereoscopic vision. For example, when human looks at photographic subject SB2 of triangular prism shape as shown on drawing 13, the left lateral S1 of photographic subject SB2 is reflected to a left eye more greatly than the right lateral S2, and the right lateral S2 of photographic subject SB2 is reflected to a right eye more greatly than the left lateral S1. Thus, when azimuth difference arises between a right eye and a left eye, human senses 3 dimensional depth.
[0074] Next, photographic subject SB2 is recorded as picture information of one sheet using an information recording device according to Embodiment 2, adding position information on the left lateral S1 and the right lateral S2.
[0075] And an information reproducing device according to Embodiment 2 is transformed, and an image for left eye and an image for right eye are reproduced, respectively, taking azimuth difference into consideration. Image SB2L for left eye which specifically consists of the right lateral S2L to which only a part of the left lateral S1L to which only a part of azimuth difference lengthened horizontally using position information, and azimuth difference shortened horizontally as shown on drawing 14 is made, only a part of the right lateral S2R to which only a part of azimuth difference lengthened horizontally, and azimuth difference makes image SB2R for right eye which consists of the left lateral S1R which shortened horizontally, and reproduces both images of an object for left eye and for right eye, respectively.

[0076] Of course, not only a photographic subject, but a background is included in image SB2L for left eye, and image SB2R for right eye. Horizontal amendment may be performed like a photographic subject also to this background. However, since the correction amounts may differ, it is possible by amendment performed to a background, and amendment performed to a photographic subject, by performing horizontal amendment to a photographic subject that a crevice arises between a background and a photographic subject. In that case, what is necessary is just to process filling up a produced crevice by a color which equalized a color of the surrounding pixel and the like

[0077] And both reproduced images turn into stereoscopic vision by being appreciated using solid glasses and the like.

[0078] An image for left eye and an image for right eye which amended distance only with a horizontal part of azimuth difference from picture information of one sheet using position information will be made if an information reproducing device according to this embodiment is used, it is not necessary to record both images of an object for right eye, and for left eye like the conventional stereoscopic vision.

[0079] <Embodiment 5> This embodiment of the invention 5 is used for precision improvement of a position measuring device of a mobile using GPS or PHS using an information recording device according to Embodiment 2. Namely, an information recording device according to Embodiment 2 making a position which was provided with a position measuring device for measuring an own position further, and was measured by a position measuring device as a temporary present location.

Position measuring accuracy is raised using position information added to picture information, and it asks for a true present location.

[0080] For example, as shown on drawing 15, each distance to 2 objects B1, B2 which serve as target points, such as a building, from a their present location is measured using an information recording device according to Embodiment 2. What is indicated on a map in a position measuring device is chosen as this object B1, B2. Next, as shown on drawing 16, range AR1 of a present location specified by a position measuring device of a mobile using GPS or PHS is displayed on map MP. If the center P1 of range AR1 is present location temporarily, the distance DG1 of P1 and the object B1 and the distance DG2 of and P1 and object B2 must be in agreement with a value of distance acquired by the information recording device according to Embodiment 2. If not in agreement, it becomes clear that a present location is not P1.

[0081] In that case, information on distance from a present location obtained using an information recording device according to Embodiment 2 to the object B1, B2 is used, circle CL1 which makes a radius distance DS1 from present location to the object B1 is drawn centering on the object B1, and circle CL2 which makes a radius distance DS2 from present location to object B2 is similarly drawn focusing on object B2. And what is necessary is just to adopt an intersection of a direction near range AR1 obtained by a position measuring device both intersection P2 and among P3 as a true present location.

[0082] If an information recording device according to this embodiment is used, it will also include a position measuring device, displaying a temporary present location on a map, and 2 objects are determined out of picture information, 2 circles are drawn which center both objects and designate the respective distance to both objects as radius and an intersection of a direction near a temporary present location is judged among intersections of those circles to be a true present location, accuracy of a position measuring device can be raised.

[0083] <Embodiment 6> In an information recording device and an information recording device which were according to Embodiment 2, a character is contained in a photographic subject or a background, and this embodiment of the invention 6 carries out the image recognition of that character, transposes it to text information, and information is saved.

[0084] It is better for data throughput to code as text information and to hold information rather than saving as bit map data when a character is contained in a photographic subject or a background. By what is considered as text information, when position information on a background or a photographic subject has change, it can process changing a font size of the text information C1 like C2 and C3, as shown on drawing 17 and the like easily. It may be made to change a color of text information, and the like according to change of position information on a background or a photographic subject in addition to this.

[0085]
[Effect of the invention] According to the invention according to claim 1, the sound information expressed from a sound source is recorded adding the position information on a sound source, the position information on a sound source can be used at the time of playback of sound information, and it can be processed to sound information.
[0086] According to the invention according to claim 2, sound information is reproduced determining the propagation characteristic of sound information using the position information on a sound source, the sound information which has a sense of reality and a 3D effect to a listener can be given.
[0087] According to the invention according to claim 3, a listener's position information is also used when determining a propagation characteristic, the sound information according to the listener's position which has a sense of reality and more 3D effect can be given to a listener.
[0088] According to the invention according to claim 4, the frequency of sound information is changed in consideration of the Doppler effect produced between the position of a sound source, and a listener's position, the sound information which has a sense of reality and more 3D effect can be given to a listener.
[0089] According to the invention according to claim 5, determining the propagation characteristic of sound information using the position information corresponding to a plurality of listeners or sound information is reproduced to a plurality of listeners, changing the frequency of sound information in addition to it, the sound information which has a sense of reality and more 3D effect for a plurality of listeners can be given.

[0090] According to the invention according to claim 6, since the picture information of a photographic subject and a background is recorded adding the position information on a photographic subject and a background, the position information on a photographic subject and a background can be used at the time of reproduction of picture information, and it can be processed to picture information. It detects whether an equal distance side shakes all over a screen, blurring is detectable.

[0091] According to the invention according to claim 7, the picture information of a photographic subject and a background is recorded adding the position information on a photographic subject and a background, the position information on a photographic subject and a background can be used at the time of reproduction of picture information, and it can be processed to picture information. The position information on a sound source is updated with movement of a photographic subject, even if the data of the temporal response of the position information on a sound source is not recordable, a sound source can be moved in accordance with movement of a photographic subject.

[0092] According to the invention according to claim 8, the picture information of a photographic subject and a background is recorded adding the position information on a photographic subject and a background, the position information on a photographic subject and a background can be used at the time of reproduction of picture information, and it can be processed to picture information. The portion focused based on position information out of the picture information of a plurality of sheets is extracted and compounded, a picture with large depth of field can be acquired.

[0093] According to the invention according to claim 9, the focused portion is extracted and compounded out of the picture information of a plurality of sheets, a picture with large depth of field can be acquired.
[0094] According to the invention according to claim 10, the picture information of a photographic subject and a background is recorded adding the position information on a photographic subject and a background, the position information on a photographic subject and a background can be used at the time of reproduction of picture information, and it can be processed to picture information. Also, including a position measuring device, displaying a temporary present location on a map, and, 2 objects are determined out of picture information, 2 circles are drawn which center both objects and designate the respective distance to both objects as radius and the intersection of the direction near a temporary present location is judged among the intersections of those circles to be a true present location, the accuracy of a position measuring device can be raised.
[0095] According to the invention according to claim 11, picture information is reproduced determining the portion which should be carried out image processing using the position information on a photographic subject, and performing image processing into the portion concerned, the compression ratio of the photographic subject which exists in the distance can be raised or a photographic subject can be separated from a background.
[0096] According to the invention according to claim 12, the position information on a sound source is updated with movement of a photographic subject, even if it does not have data of the temporal response of the position information on

a sound source, a sound source can be moved in accordance with movement of a photographic subject.

[0097] According to the invention according to claim 13, the image for left eye and the image for right eye which amended distance only with a horizontal part of azimuth difference from the picture information of one sheet using position information are made, it is not necessary to record both the images of object for right eye, and for left eye like the conventional stereoscopic vision.

[0098] According to the invention according to claim 14, the picture information of a photographic subject and a background is recorded adding the position information on a photographic subject and a background, the position information on a photographic subject and a background can be used at the time of reproduction of picture information, and it can be processed to picture information. The picture information also includes text information, it can use the position information on a photographic subject or a background at the time of reproduction of picture information and can be processed to text information.

[0099] According to the invention according to claim 15, a picture information also includes text information according to the position information on a photographic subject or a background, a size, a color, and the like of a font of text information can be changed.

[Brief description of the drawings]

[Drawing 1] is a drawing showing the scene where the information recording device according to this embodiment of the invention 1 is used.

[Drawing 2] is a drawing showing the scene where the information reproducing device according to this embodiment of the invention 1 is used.

[Drawing 3] is a drawing showing each parameter in the Doppler effect.

[Drawing 4] is a block diagram showing the composition of the information reproducing device according to this embodiment of the invention 1.

[Drawing 5] is a block diagram showing other composition of the information reproducing device according to this embodiment of the invention 1.

[Drawing 6] is a block diagram showing the composition of the information recording device according to this embodiment of the invention 2.

[Drawing 7] is a drawing showing the blurring amendment in the information recording device according to this embodiment of the invention 2.

[Drawing 8] is a drawing showing movement of the photographic subject in the information recording device or information reproducing device according to this embodiment of the invention 2.

[Drawing 9] is a drawing explaining depth of field.

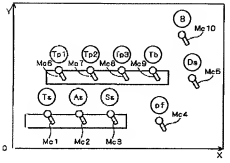
[Drawing 10] is a drawing showing the circumstances that a photographic subject is captured using the information recording device according to this embodiment of the invention 3.

[Drawing 11] is a drawing showing the circumstances that a picture is combined using the information recording device according to this embodiment of the invention 3.
[Drawing 12] is a drawing showing the circumstances that the photographic subject which has a field which is not parallel to an imaging surface is captured.
[Drawing 13] is a drawing explaining a stereoscopic vision.
[Drawing 14] is a drawing showing the image made by the information recording device according to this embodiment of the invention 4.
[Drawing 15] is a drawing showing 2 objects which serve as a target point in the information recording device according to this embodiment of the invention 5.
[Drawing 16] is a drawing showing how to judge the present location in the information recording device according to this embodiment of the invention 5.
[Drawing 17] is a drawing showing the circumstances that the size of a character changes in the information recording device according to this embodiment of the invention 6.
[Drawing 18] is a drawing showing the conventional stereo sound information.
[Drawing 19] is a drawing showing the image of the sound field data of the conventional stereo sound information.
[Drawing 20] is a drawing showing the image of the sound field data of the conventional 3D sound art.

[Description of numerals]

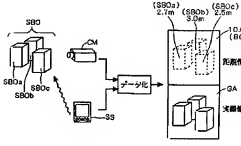
SD1 - SD10 audio track data
IFS Sound source position information
IFL, IFLa - IFLc Listeners position information
ST1, ST1a - ST 1c Relative relation calculation processing block
ST2 pitch change processing block
ST3 Propagation characteristic change processing block
ST23a - ST23c Sound reproduction process processing block
ST4 Sound reproduction processing block
ST4 a-ST4c Sound reproduction processing block classified by listeners
CM Imaging device
SS sensor element
SBO, SBOa - SBOc, SB1, SB2 Photographic subject
OB Object
FP1 - FP7 Focusing point
D1 - D7 Depth of field
AR1 Range specified by a position measuring device
B1, B2 Object used as a target point
C1 - C3 Character font

Drawing 1



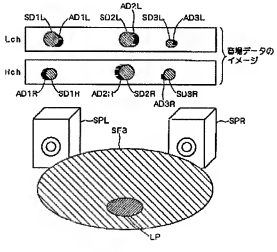
Drawing 3

Drawing 6

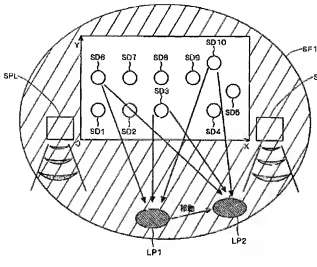


Drawing 9

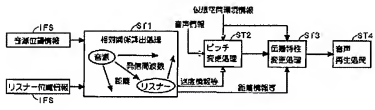
Drawing 20



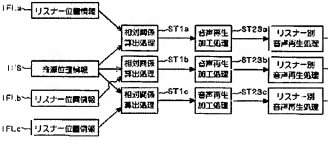
Drawing 2



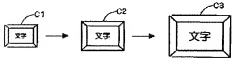
Drawing 4



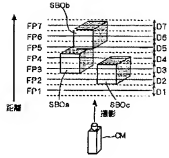
Drawing 5



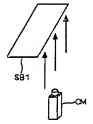
Drawing 17



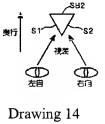
Drawing 10



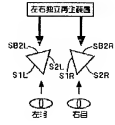
Drawing 12



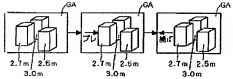
Drawing 13



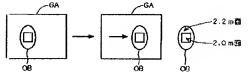
Drawing 14



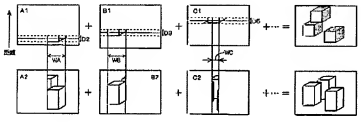
Drawing 7



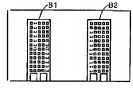
Drawing 8



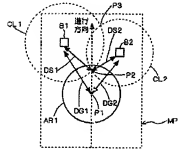
Drawing 11



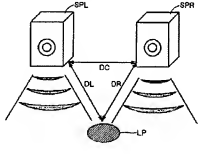
Drawing 15



Drawing 16



Drawing 18



Drawing 19